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RECENT ADDITIONS TO OUR KNOWLEDGE
OF MALARIA IN THE PUNJAB

E. L. PERRY

1914



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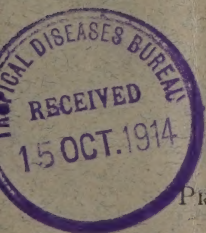
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(A paper read before the Punjab Branch of the
British Medical Association at Simla, on
July 17th 1914.)

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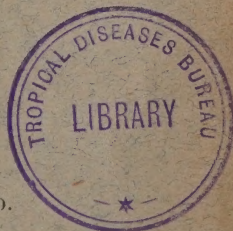
Lately on special duty under the Government of India
for the Investigation of Endemic Malaria in the
Jeypore Hill Tracts of the Madras Presidency.



SIMLA;

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RECENT ADDITIONS TO OUR KNOWLEDGE OF MALARIA IN THE PUNJAB.

THE greatest problem that faces the Sanitary Department of the Punjab is how to deal effectively with malaria. In this paper therefore I will confine myself mainly to observations on malaria in the Punjab and will only refer to observations on malaria in other parts of India, when it is necessary to do so, in order to throw light on the conditions met with in the Punjab.

The great epidemic of malaria in the Punjab in the autumn of 1908 which caused in a few months the deaths of far more than a quarter of a million persons, very naturally attracted world-wide attention. It acted as a powerful stimulus to the desire for research and indirectly was in no small measure responsible for the taking of much active interest in sanitation and the rendering of much practical assistance thereto, which has been

so marked a feature of the policy of the Government of India during recent years, since Sir Harcourt Butler assumed charge of and organized the newly created Department of Education and Sanitation.

These great epidemics which Christophers has aptly called fulminant epidemics are unfortunately only too familiar a feature in the history of the Punjab. From their economic aspect their effects on the progress and developement of the Punjab must be so serious and far reaching that the administration will be justified in expending vast sums of money if practical and enduring means for mitigating their severity can be devised. The investigations undertaken by Christophers and the investigations undertaken by myself have increased and not diminished our hopes of ultimately devising measures to deal with them.

I will now discuss important facts which have come to light. Christophers mapped out the mortality of the epidemic of 1908 and his map is appended to his *Malaria in the Punjab*.*

*S. R. Christophers. *Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India*. (New series). No. 46. Calcutta, 1911.

He has mapped out in other maps the mortality in the epidemics of other years. From his map it is evident that the incidence of mortality in 1908 was very far from regular. Large areas of the Province escaped any serious mortality. There were certain areas of very intense incidence of mortality, for instance in the Gujrat, Amritsar and Gurgaon Districts.

Christophers found that in the different years, in which epidemics occurred, the mortality did not necessarily affect the same areas. Each epidemic had its own map.

A most important fact which he has demonstrated is that irrigation has no special relation to the distribution of the mortality in these epidemics. It is true that the Amritsar District is in parts very heavily irrigated and suffered severely in 1908 but at the same time the Gujrat District which is unirrigated was affected with equal if not greater severity. When Christophers mapped out the rainfall for the years in which he mapped out the mortality from the epidemics he failed to find any orderly relation between incidence of rainfall and incidence of mortality. Christophers has demonstrated, with the aid of

these maps, that there is a marked tendency for the areas of mortality in these epidemics to be situated somewhat beyond the areas of heaviest rainfall and to extend along the great rivers. He therefore came to the conclusion that the hydraulic factor involved in the causation of an epidemic was not rainfall but flooding.

If we study what was written of malaria in the Punjab many years before Laveran's discovery of the parasite we come across striking descriptions of these fulminant epidemics. It was very many years ago accepted as an axiom, by very capable observers, that in the Punjab, although the very driest years were invariably years remarkably exempt from outbreaks of malaria, the reverse rule did not rigidly hold good, the very wet years not always proving to be the worst as regards malaria. It was also known that an epidemic often occurred when a year of heavy rainfall followed on a year of deficient rainfall. Now deficient rainfall raises prices and Christophers by studying rainfall statistics and statistics concerning the cost of foodgrains devised a method of estimating the probable number of deaths from fever in any year. In a table

in Paludism* he deals with all years back to 1868 and on the whole his method gives results very near the actually observed mortality though there are several anomalous years. Christophers therefore held that one of the factors which predisposes the community to suffer from a fulminant epidemic is diminished resistance to malaria consequent on shortage of food. In the opinion he put forth I fully concur. But shortage of food is one of the predisposing causes. When food is scarce the whole province feels it more or less but even after years of great scarcity the mortality from malaria is most unevenly distributed and to account for this we must look for some exciting cause which is irregular and capricious in its incidence and such a cause is extensive flooding.

The point I desire to impress upon you is, that Christophers has shown, that portions of the province (known to be capable of suffering from severe fulminant epidemic malaria) often do, after a period of scarcity, escape undue mortality from malaria, during a season when other parts of the province are suffering terribly. It is this fact that gives us great hope that, even in the presence of

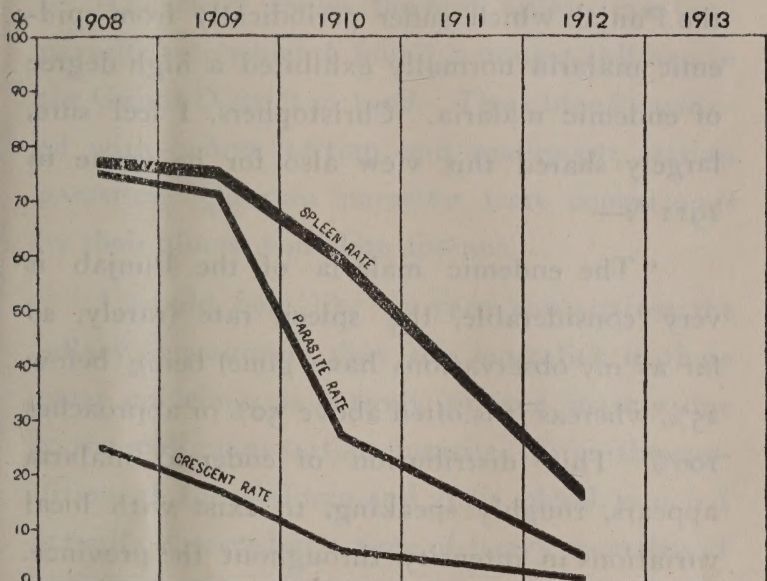
* S. R. Christophers. *Paludism*, p. 26 No. 2 January 1911.

the predisposing factor scarcity, if we could control the exciting factor we might yet do much to mitigate these fulminant epidemics.

Christophers gave us an enormous amount of information concerning the actual epidemics of malaria. We are under a great debt to him for the labour and skill wherewith he caused vast and bewildering masses of statistics to crystallize into systematic and intelligible order.

To throw yet further light on the relationship of these fulminant epidemics to the factors causing them it was necessary to study the malaria of the community in the periods between the epidemics. I now therefore take up the subject at the point where Christophers' investigations left us and will deal with my own investigations and the light which they have thrown upon the subject.

The gist of my observations is shown in the chart. Under orders from the Punjab Government to determine the actual cause of the mortality in the Gujrat District in 1908 and to devise means whereby the recurrence of such epidemics might be prevented, I commenced systematic observations in that district before the mortality



FALL IN RATES AFTER 1908 EPIDEMIC. KHATALA CUJRAT PUNJAB (PERRY)

from the epidemic had ceased. The lower part of the Gujrat District is liable to flooding from the Bhimbar nullah which brings down the rainfall from the mountainous regions above it. In 1908 there had been very extensive flooding of the District from the Bhimbar nullah. Khatala being a large village which had suffered excessively I chose it and the villages in its neighbourhood for special observation.

When I commenced these observations I was strongly under the impression that all parts of

the Punjab which suffer periodically from epidemic malaria normally exhibited a high degree of endemic malaria. Christophers, I feel sure, largely shared this view also for he wrote in 1911 *:—

“The endemic malaria of the Punjab is very considerable, the spleen rate (rarely, so far as my observations have gone) being below 25%, whereas it is often above 50% or approaches 100%. This distribution of endemic malaria appears, roughly speaking, to exist with local variations in intensity throughout the province. But in normal years this state of widespread malarial infection is not associated with any special mortality; and even in epidemic years considerable portions of the Punjab, though they show a considerable degree of endemic malaria, do not suffer from the epidemic conditions or exhibit any special mortality.”

We knew that areas like the Neli tract of the Ambala District which had been known since many years to have a high spleen rate did not necessarily show a high mortality in years when epidemic malaria appeared in the Punjab.

* Ibid. p. 20.

The chart shows the high spleen rate and parasite rate which I found amongst children in the Gujrat District in 1908. Their blood swarmed with benign tertian and malignant tertian parasites. Quartan parasites were conspicuous by their almost complete absence.

I would here like to warn you against the fallacy of assuming that the mortality in these great epidemics is entirely or even mainly due to the malignant tertian parasite. From the condition of the children and their blood, which I actually observed at a time of heavy mortality, I am convinced that the benign tertian parasite was a great factor in that mortality.

Observing again 1909 I found but little difference. So little did I know as to what the normal condition in such a district as regards malaria, actually was, that in 1909 on the subject of these high spleen and parasite rates I wrote in my report to the Punjab Government. "High as the endemic index was, we are not justified in assuming that it was so solely in consequence of the great epidemic of 1908. It is quite possible that the normal endemic index may be as high as this. There is a reasonable probability that

the height of the endemic index was due to the great epidemic but we must be prepared to regard this as an open question until investigations in future years demonstrate what the normal endemic index in this locality really is" That statement passed the scrutiny of Adie, James and Christophers, all of them workers with wide experience of malaria in the Punjab, without exciting any special comment.

The "future years" above referred to have come and gone and my observations have disclosed a state of things of which I had at the commencement absolutely no conception. I was indeed prepared for a considerable fall in the spleen and parasite rates perhaps to 50% or even to 40%. In 1910 the parasite rate showed signs of deserting me but the spleen rate still remained fairly faithful and so little did I suspect how it would, in subsequent years, behave that in writing of these observations I stated.* "It appears from these figures that in areas subject to severe epidemic visitations of malaria, the spleen rate is a less fluctuating index of the malarial potentialities of such localities than the endemic index

* E. L. Perry, *Paludism*, No. 39, July 1911.

(parasite rate)." I was prepared to regard the parasite rate as unreliable but I still clung to the spleen rate and reposed a confidence in its stability, which later observations have proved to have been utterly misplaced.

In the latter part of 1910 I left the Punjab to undertake investigations for the Government of India into endemic malaria in the Jeypore Hill Country of the Madras Presidency. After my return I was able to visit the Khatala villages in the autumn of 1912. The fall in the spleen and parasite rate which I then found was startling. I found also that this fall was not confined to the neighbourhood of Khatala. The spleen rate at Gumtala, a village close to Amritsar, had, I found, fallen from 90% in 1908 to 15% in 1913. That of Palwal in the Gurgaon district had fallen from 85% in 1908 to 25% in 1913. During the same period the spleen rate of Atari, which is midway between Lahore and Amritsar had fallen from 80% to 30%. The fall in the spleen rate of the Punjab was wide-spread and Captain Gill, I.M.S., who is now engaged in a comprehensive survey of the malarial conditions of the Punjab, informs me that the spleen rate continues to fall.

On the other hand, however, I found certain places where the spleen rate in 1913, still remained high. At Baghbanpura, close to Lahore, it was 50% although in Lahore City itself it had fallen as low as 5%. At Dharawal in the Gujrat district, some ten miles from Khatala, it was 60%, while in the Gurgaon district the villages of Chapera, Chachera and Kira showed spleen rates respectively of 100%, 80% and 68%.

It will be seen now that in the Punjab the prevalence of the malaria parasite and the prevalence of enlargement of the spleen are both subject to an enormous degree of fluctuation. But it will also be noted that there are places or foci where the spleen rate always tends to remain very high. It was with a view to discovering such places that I recommended that a spleen census of schools be taken in the Punjab. This is now being carried out. In 1908 the malaria monster was clothed with abundant flesh but now he has passed through several lean years and his ribs are showing through his hide. The places where malaria is seriously endemic must still show a high spleen rate and these are the places we want to search out for they should demonstrate to us

what local conditions most affect malaria and the degree to which they affect it as compared with seasonal, that is to say epidemic conditions.

Our policy must be to determine with ever increasing accuracy the factors which affect malaria in the province and then to deal with them as far as we are able. In the Gujrat district, where I have made special observations, we should determine the influence on malaria of the Bhimbar nullah.

The great fall in the spleen rate of the Punjab, which my observations, carried on since 1908, have brought to light, is indeed phenomenal and our eyes are now opened to the extraordinary degree to which epidemic conditions affect malaria in our province. In view of these phenomenal changes we realise how incautious it would be to dogmatise on the effect of this or that anti-malarial measure, in the Punjab, in the absence of observations prolonged over many years.

There is a great contrast between the Punjab and countries ^{where} malaria is constantly and highly endemic. One of the results, of the observations, which I recorded in the Jeypore

Hill Tract of Madras, is to cause things which we regard, from our long familiarity with them, as common-place facts of malaria in the Punjab, to stand out as distinct and striking phenomena. We have evidence that the aborigines of countries, where malaria is endemic in a high degree, show but little effect of the parasites which they harbour in large numbers in their blood. It is a somewhat vexed question as to what this phenomenon should be called. Some call it "tolerance," some call it "immunity" and I personally use the latter expression largely in discussing the subject. I am however on absolutely safe ground when I refer to the reaction of different races to malaria. It is of interest to note the extent to which the Punjab has been peopled by immigrant races from the North within historic times and to seek what light we can on the amount of tolerance of the parasite and immunity to its effects, which they possess or have the power to develop, during the course of their lives, as compared with the aborigines of India who have peopled the peninsula since prehistoric times.

In my enquiries into endemic malaria, in the Jeypore Hills, into the details of which I will

not enter here, as they form the subject of a paper about to appear in *The Indian Journal of Medical Research*, I was able to demonstrate three outstanding features, by which the aborigines differed from recent immigrants, in their reaction to identical conditions of exposure to infection with malaria. The aborigines show high spleen rates amongst children, low spleen rates amongst adults—both in children and adults very large spleens are excessively rare—although the aborigines show much infection with malignant tertian malaria, malignant tertian crescents are most remarkably scarce. The recently immigrant races show high spleen rates amongst children and also high spleen rates amongst adults—both in children and adults excessively large spleens are of frequent occurrence—immigrants when infected with malignant tertian malaria show large numbers of crescents in their blood. (This last phenomenon Sir Ronald Ross tells me is frequently remarked on the West Coast of Africa).

It is difficult for us to compare the fluctuating spleen rates of the Punjab races with the (what we believe to be) fairly stable spleen rates of the

aborigines of a country where endemic malaria is great. On the second point however we can compare the races and we are familiar with the fact that both in children and in adults in the Punjab excessively large spleens are of very frequent occurrence. We also know, that in the races of the Punjab, when they suffer from malignant tertian malaria, malignant tertian crescents swarm in their circulation. These facts are peculiar but they are very evident and I consider that they label the Punjab races as nonimmune races. When I tell you that there is evidence that certain tribes, who have lived for at any rate several hundreds of years in the Jeypore country, have not yet attained to the same reaction to malarial infection as the aborigines and that in such countries infection is occurring during almost every month of the year, we can readily understand why the Punjab races who have come down within historic times from the North and who are exposed to infection during a short period only of each year and even then in very varying degree have not acquired what I have termed immunity.

These facts are of very great importance, for

they have led me to hold that the people of the Punjab should readily exhibit a high spleen rate if exposed to a considerable degree of infection with malaria. I feel sure that when the spleen rate falls as low as it has at Khatala that the amount of endemic malaria in such a place is in all probability very small indeed.

Therefore the more we study the question the more does the importance of the epidemic come into prominence and the more does endemic malaria recede.

✓ If in these areas, subject to epidemic visitations, endemic malaria was very severe, the task of dealing with malaria might appear well nigh hopeless. But when we study such an area and discover that, far from what we had originally supposed, in the absence of epidemic conditions, such an area can become comparatively healthy, and when we also remember that even in severe epidemic years such an area may escape a visitation, we realise then how preponderating is the effect of the exciting cause of an epidemic. I feel convinced from the evidence Christophers has collected, that the great exciting causes of these epidemics are

floods, If I am correct I think you will all agree that, judging from great achievements in the Punjab in the past, the genius of our engineers will some day devise means of controlling these disastrous floods. ✓

That these floods are not entirely evil in their influence I am well aware, for they bring down silt of enormous value. But to sacrifice a quarter of a million persons in bringing silt on to the land is a method unnecessarily calamitous. Ways will, I feel sure, be found to control these floods and yet retain their benefits. The problems of the control of malaria are largely problems of the general administration and not of special administration. Malaria, as I have said elsewhere, is a disease of waste water, waste land and waste people and all three problems are daily present in the minds of the administrators of the Punjab.

We take it that the exciting causes of these violent fluctuations must be looked for in physical occurrences which, even when we have determined them accurately, cannot be ameliorated by any policy of the administration under a period of very many years. It is necessary therefore to have a subsidiary but more immediately

applicable policy directed to the alleviation of malaria as it does occur. It is humane, economical and absolutely essential that we should do everything possible to reduce the damage, wrought by these epidemics of malaria, by means of treatment with quinine.



